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AUTHOR	Cureton, Thomas K.
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ABSTRACT

In this document, "middle age" is defined as the 26- to 65-year age span during which there is a steady decline of both physical and mental capabilities and a change for the worse in personality traits. The document summarizes the findings of recent training experiments in adult health and physical education that indicate possible ways of postponing some aspects of physiological aging. Some topics discussed include the beneficial results from a) body locomotion and progressive endurance exercises; b) vitaminization (especially Vitamin C, which is not manufactured by the body); and c) physical training, which according to one study influences a common denominator that accelerates growth, decelerates aging, and prolongs life. (JA)

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PRESIDENT'S COUNCIL ON PHYSICAL FITNESS AND SPORTS

TRENDS OF RESEARCH ON PREVENTION OF PHYSIOLOGICAL AGING AND THE VALUE OF EXERCISE FOR FITNESS AND HEALTH

Thomas K. Cureton, Ph.D.

Aging Associated with the Loss of Physical Abilities

Physiological aging is the gradual loss of physical powers and capacities after gradual build-up to 17, the plateau extending from 17 to 26; and the decline beginning as an average about 26 years of age. We define "middle age" as the 26 to 65 age span during which there is a steady loss of various powers and abilities; this followed by the geriontological (66+, old age range) now of accelerated interest to gerontology and specifically to geriactrics medicine. However, research indicates that chronological age is a poor classifier and actual functional fitness tests are better to indicate the degree of integration between the mind and the body--i.e., the capacity to work and the distance away from schizophrenia.

We have studied many men in the 26 to 60 age range, several thousand "white collar" and "professional men." In this group are approximately 1000 YMCA adult members from 50 cities, 125 Methodist ministers, several hundred professors and laboratory workers, 300 school teachers, 300 business men and 100 supervisors and foremen in mills South of Chicago, 100 farm advisers from Illinois and miscellaneous "service" workers of the non-academic class. More recently, we have added approximately 100 dentists and a few MDs. The curves of 60 fitness tests go steadily downward after 25 years of age.

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It is interesting that Professor Raymond B. Cattell, Jones and Kaplan, and Miles and Duggan point out the parallel trend for certain mental abilities to decline after 25 years of age; and that Dr. Josef Brozek similarly points to the parallel loss of certain desirable personality characteristics with aging.

The physical tests which decline more or less independently of constitutional body type include: (1) accumulation of fat, (2) lowering of basal metabolic rates, (3) loss of muscular strength, (4) slowing of reaction time, (5) reduction in motor fitnesses, such as: balance, flexibility, agility, power and endurance, (6) reduction in work capacity and associated oxygen intake capacity during attempts at hard work, (7) reduction in speed and color discrimination, accommodation to night vision, changes in time of focal accommodation,(8) reduction in respiratory reserves (breath holding and ventilatory capacity), (9) increase in ligamentous injuries and dislocation strains in the shoulders, knees, spine and inguinal region, (10) increase in peripheral resistance, blood cholesterol and blood pressures, (11) decrease in arteries resiliency and suppleness (sometimes called aortic tree elasticity), (12) loss of capacity to adjust to intensive speed work or stress suddenly imposed. All of these losses add up to loss of the fitnesses needed in athletics although considerable skill can be retained. These fitnesses can generally be improved by exercises and improved nutrition as various studies show.

The mental abilities which decline are: (1) computational speed, (2) memory, (3) mental energy, (4) mental adjustment to new situations, (5) ability to relax, and (6) reasoning.

The personality traits which change for the poorer with age may be· (1) loss of physical courage, (2) less participation in dynamic (extrovert) activities (sports, exercise and physical work), fear of personal exposure to weather and physical accidents, fear of loss of health, (3) greater introversion and preoccupation with money, competition and responsibility. In thesesby Betz, Wells and Breen at the University of Illinois eight of Cattell's 16 Personality Traits were significantly correlated with "All-Out" Treadmill Running Ability. The traits which were negatively correlated with endurance were: (1) Sophistication, (2) Fear for self, (3) Anxiety, (4) Sensitiveness to aesthetic stimuli, (5) Viscerotonic Tendency (to over-eat, and over-drink), (6) Cebrotonic tendency (over-concern with intellectual pursuits), (7) Mental fatigue symptoms, (8) Mental-physical integration (will-power).

A recent study at the University of Michigan by Dr. John C. Tappen on 294 academic professors (80% in 50-60 year span) was the marked increase in gastrointestinal disorders, diabetes, nervous and cardiovascular disorders, which we fully believe regular exercise does effect.

The Significance of Recent Training Experiments in Health and Physical Education

A brief summary points up the importance of research in exercise and sports to adults.

1. The experiments on strengthening muscle, like those by Hettinger and Mueller, in Germany, indicate that hard resistance exercise (50 to 80% of maximal), done for short daily periods will increase maximal dynamometer strength of specific muscles but several studies show parallel absence of circulatory-respiratory, metabolic and endurance improvements.

2. Track sprint work, wrestling, boxing, weight training, carrying loads, throwing weights or medicine balls, rowing or resistance cycling or chopping wood will increase strength/weight, power, and reaction speed response of the whole body.

3. Endurance running, swimming, cycling, rowing, skiing and all such body locomotive (transportation) exercises will improve muscular endurance and also all of the 5 components of circulatory-respiratory fitness if the work is sufficiently long, regularly repetitive and intensive enough. Some antonomic tone shift from parasympathetic to sympathetic dominance can result. Such training will reduce inner tension (anxiety) and shift parasympatheticotonic types to or toward normality.

4. Fat can be reduced, specific gravity increased, blood cholesterol lowered and basal metabolism lowered by a combination of progressive endurance exercised combined with wheat germ oil feeding just before or after the workouts on an empty stomach; and in such a program enlarged hearts can be reduced in size in older men. Marked reduction in peripheral resistance usually accompanies such training if it is gradually brought up to hard exercise and is long enough continued.

5. The most fascinating type of improvement, reflected in over a hundred graduate theses and faculty researches at the Physical Fitness Research Center of the University of Illinois, is the improvement in cardiovascular condition, with reasonable expectancy that prevention of coronary thrombosis can result, or at least its postponement. In seventeen years of

this work with older subjects, 30-70 years of age, not a single coronary attack has occurred in sedentary men all around the work in the same locality. We fully believe that most sedentary men in this age span need such preventive conditioning.

6. Dr. Ancel Keys and Dr. Torgy Sjostrand have fully emphasized the deteriorating effects of too much bed-rest hospitalization resulting in the loss of blood volume, the reduction of hemoglobin, the loss of stamina and deterioration of strength.

7. During stressful physical training wheat germ oil, Vitamin A and B (Thiamin), Vitamin C (Ascorbic acid), seem to permit human subjects to make better performances and permit the performers to enjoy the work more, with fewer absences, alibis and soreness. Perhaps adequate vitaminization, especially vitamins not manufactured in the body, like vitamin C, do bolster cortisone (ACTH) formation (the antistress hormone). Vitamin E, lineolic acid and an unknown factor in wheat germ oil are associated with more glycogen being deposited in the muscles and liver, meanwhile depressing cholesterol. ACTH is secreted from the anterior pituitary gland and the stress signals are regulated by the hypothalmus. This is identified as the chain reaction of Selye, which causes the adrenal gland to liberate cortisone to bolster the body against stress.

8. High strength is associated with high motor performance, social prestige and personal adjustment. Simonsen noted that high strength, and high R and T waves are indicative of better nutritional status and also appear to parallel longevity. Several studies have shown that endurance training and WGO increase the latter.

9. Dr. E. Jokl states that physical training influences a common denominator which accelerates growth, decelerates aging and prolongs life. In addition to his own work in Marburg Gymnastic Festival in 1954, he bases this deduction upon data of Dr. Carl Diem and Dr. M. Karvonen, on Olympic athletes, and those of Dr. T. K. Cureton on conditioning children and reconditioning middle aged men, and Cureton's work comparing former athletic champions in and out of training with data on young men and young athletes.

10. The classical demonstrations of Dr. Joel Golthwait of Boston of respiratory training during higher neck and chest posture, to give more excursion to the diaphragm, improved venous return to the heart, increased the heart-lung circulation, and improved the function of the pancreatic gland to relieve diabetes, are reiterated and emphasized by Dr. C. L. Lowman, of Los Angeles. The great emphasis on exercise by heart specialists, like Dr. Paul D. White, Dr. (Gen.) McSnyder, Dr. T. G. Klump, Dr. Page and others in the last few years indicate increased faith in exercise as a valuable adjunct to heart treatment.

11. Improved flexibility can be developed by stretching, application of heat, 20-40 mins. warm-up, and by regularly doing full range movements to the full capacity of the joints and chest cage.

When connective tissue is not actively elongated, it steadily shortens. If it carries a constant load it thickens, and this may cause an irritating pressure on nerves passing through it. Such irritations can feed back to upset the delicate balance of the autonomic nervous system and the endocrine system.

Stretching usually relieves neck and lower back pains and relieves neuromuscular hypertension anywhere. Stretching in directions opposite to gravitational force is generally implied.

12. Proneness to strains, dislocations and "slipped discs" in the joints is preventable, in the opinion of experienced trainers, coaches and exercise directors in the physical education field. In addition the earlier evidence of Drs. R. Tait Mackenzie, of Philadelphia, Cyriax of London, and Joel Goldthwait of Boston, Hans Kraus of New York, Phelps and Kiphuth of New Haven, Rusk of New York give recent support to the value of conditioning throughout life. Active use of the joints prevents dehydration; stretching minimized the compression pains; and swimming is ideal to relieve the stresses of gravity and neuromuscular hypertension.

13. Rehabilitation exercises should be highly specific to the injury, structural disability or deteriorated part. It is significant that "kinesiotherapy" courses have been added to the graduate training in corrective therapy and physical education. Good manuals or lists of exercises have been developed by Dr. C. L. Lowman, Dr. H. J. Brenner, Dr. G. T. Strafford, Dr. C. H. McCloy, Dr. Hans Kraus, Major J. G. Thulin, and others; and also by the staff at Hines Government Rehabilitation Hospital, Chicago, and other similar rehabilitation units. Physiatrists and specialists are becoming increasingly effective with better trained physical education personnel to do more of the work. Many specific researches are available in hydro, mechano, heat, light, electric, and supersonic therapy. Dr. C. L. Lowman states, "Unless the joints are exercised through full ranges and the flexor-gravity pull are counter-

balanced, habitual musculo-skeletal imbalances will arise with aging--giving rise to feet and leg aches, cramps, poor circulation, backaches, shoulder, spine, hip, pelvis, and neck pains (commonly called bursitis, neuritis, fibrositis or arthritis).

14. Speed of vision may be improved and eye fatigue relieved by persistent practice of seeing fast moving balls or objects in general, (as in handball, tennis, table tennis, baseball, golf, etc.) by eye movement exercises, and by physiological warm-up and cold baths (i.e., cold water spray or ice packs on the lower abdominal region). Night vision may be improved by training and by Vitamin A dosage.

15. Balance (kinesthetic sense) can be readily improved by work on balance beams, cycles and unicycles, skates, skis, and by diving, gymnastic balancing and dancing.

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